

Wageningen University

Bachelor Thesis

**The Acceptance of Personalised Nutrition Advice
among Consumers**

Date	10-06-2020
Name	Marloes van Bleijswijk (980705071060)
Supervisor	Ellen Van Loo
Second Reader	Nikita Sharda
Study	Management and Consumer Studies
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Introduction

Worldwide 39% of adults aged 18 years and older were overweight in 2016 and around 13% of these overweight adults were obese. In 2018 over 40 million children under the age of 5 were overweight or obese (World Health Organisation, 2020). These are shocking numbers and show the global problem of obesity. Obesity can bring an increased risk of diabetes, coronary heart disease, arteriosclerosis, hip fracture and gout for people who were overweight as adolescents (Maffei & Tatò, 2001). These diseases are serious and therefore obesity is a reason for research about the effects and prevention of obesity. A predominantly easy solution to the prevention of obesity is a healthy diet. There are various developments and innovations to help consumers attain a balanced healthy diet. In the Netherlands 'De Schijf van Vijf' is an existing tool for consumers to help them to eat variety of all necessary nutrients during a day (Voedingscentrum). More countries such as America (My Plate guide to healthy eating) and Japan (Shokuiku) have comparable tools to help people consume a varied diet (USDA ChooseMyPlate) (Cees, 2016). These tools are made for consumers in general to have some guidelines in their diet. However, not all consumers are the same and not all consumers need the same nutrients in their diet. Therefore more specific advice for the individual consumer could be a way to create an even healthier and more balanced diet.

More and more websites are using personalised services to provide a tailored experience to their visitors. Even when you are not logged into an identity account, third party services are still able to collect valuable information about you (Puglisi, Rebollo-Monedero & Forné, 2017). For example, advertisements that you may receive during your online searches might be based on your previous search history.

Your online searching data is gathered mostly by third parties who gather your information and create a personal profile. This profile can be sold to other companies that use it to offer you personalised advertisements. There are many different opinions about these kinds of advertisements. Some are against this kind of data tracking because of the violation of their privacy. The public's concern about online privacy is quite high (Metzger & Docter, 2003). They are scared of the idea that people and companies know everything about them and can adjust their way of advertisement based on this information. Irrespective of the concerns about privacy, online shopping is still one of the most popular activities worldwide. Global e-retail sales have reached 3.5 trillion U.S. dollars in 2019. Comparing e-retail sales to the total retail sales worldwide, 14.1 percent can be assigned to e-retail sales. It is expected that this number will grow to more than 22 percent in 2023 (Clement, 2019).

Based on global e-retail sales, online shopping among consumers is increasing. However, is this also applicable to the e-retail of groceries? In the Netherlands there are no exact numbers of the amount of money spent on online grocery shopping in 2019 (De Best, 2019), but according to figures of the Dutch research institute GfK, 3.6 percent of the Dutch turnover of the Dutch supermarkets in the first quarter of 2018 was due to online retail. In the third quarter of 2018 it has already risen to 4.1 percent (Logistiek, 2019), so the online retail for groceries is growing steadily in this period. Comparing these numbers from 2018 with the market share of online retail of groceries in 2016, it shows a growth of 1.8 percentage points. The market share of online retail for groceries is growing over time and is predicted to continue to grow in the future (Conway, 2020).

This growth is giving new innovations the opportunity to arise. One of these innovations is Personalised Nutrition (PN) advice. Nutritional advice has moved further than the “one size fits all” population-level recommendations for healthy diets and healthy lifestyles (Ronteltap, van Trijp, Berezowska, & Goossens, 2013). According to Ordovas, Ferguson, Tai & Mathers (2019), personalised nutrition is defined as an approach that uses information on individual characteristics to develop targeted nutritional advice, products or devices. The kind of information they used for PN is assigned into two different approaches: Biological information and motivational information. Biological information can be seen as the response to nutrients dependent on phenotypic and genotypic characteristics. Motivational information consists of the characteristics that motivate people to make appropriate changes in their daily diet such as current behaviour, preferences, barriers and objectives and subsequent delivery of interventions (Ordovas, Ferguson, Tai & Mathers, 2019). For this article these two approaches of information will be used in explaining the different ways to offer PN advice.

There are several existing tools to get PN advice. In the Netherlands “Mijn Eetmeter” is such an application that will give consumers nutrition advice based on their daily consumption. In this mobile app consumers have to declare their daily consumption, and this application then measures if you eat a variety of foods and what nutrients you should consume (Voedingscetrum). Another application is The Naked Nutritionist, a website offering PN advice based on a complete case history, using available biochemical, genetic testing and analysis. Some supermarkets in the Netherlands make use of the trend of PN advice and offer applications where you can put together healthy meals and find the recipes for these meals (Allerhande).

For food retailers it could be interesting to have knowledge about the motives of customers who buy their food online so they can apply this knowledge to a better online environment. But it would be even more valuable to have knowledge about individual persons and their motives to shop for their groceries online. For the consumer PN advice could be valuable for several reasons. According to Celis-Morales et al. (2017) personalised recommendations based on diet are more effective than general recommendations on a healthier diet choice for all consumers. For consumers with diseases such as diabetes personal nutrition advice can be very helpful, because patients find it hard to find a suitable diet (Evert et al., 2014).

However, it is unsure whether consumers want PN advice. To get a better insight the research question of this paper is:

What is the acceptance of personalised nutrition advice among consumers?

To answer this question two sub questions are formed:

Q1: What are the factors influencing consumer acceptance of personalised nutrition advice?

Q2: How do the factors influence the acceptance of consumers towards personalised nutrition advice?

Theoretical Framework

For the theoretical framework the models of Ronteltap & van Trijp (2007) (Figure 1) and Ronteltap et al. (2007) (figure 2) have been used for the theoretical explanation of consumers adoption and societal diffusion of innovations in general and technology based food innovations in particular. For this research this is important because it will give a better insight into consumer decision-making regarding the food industry. It can help to determine the factors that influence the consumer decision-making and setting up a useful query.

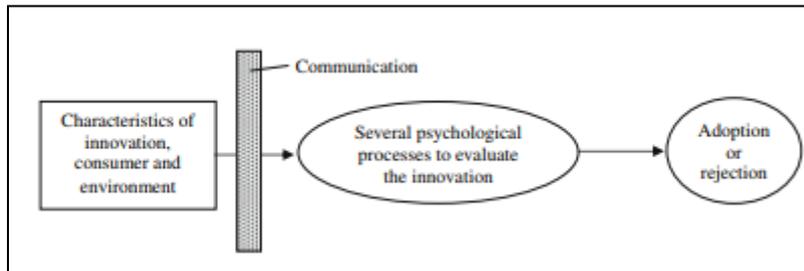


Figure 1. Conceptual framework for consumer adoption of new technology (Ronteltap & van Trijp, 2007)

The first model of Ronteltap & van Trijp (2007) explains the simplified path the consumer takes in order to adopt or reject a certain innovation. The first model says the consumer takes three steps when deciding to adopt or reject an innovation. First it looks at the characteristics of the innovation, the consumer and the environment. After looking at these characteristics the communication of the innovation will be looked at. The way an innovation is communicated to the consumer can influence the end- decision. The last step in this process is the several psychological processes to evaluate the innovation. In the second model (figure 2.) the simplified first model will be explained in more detail.

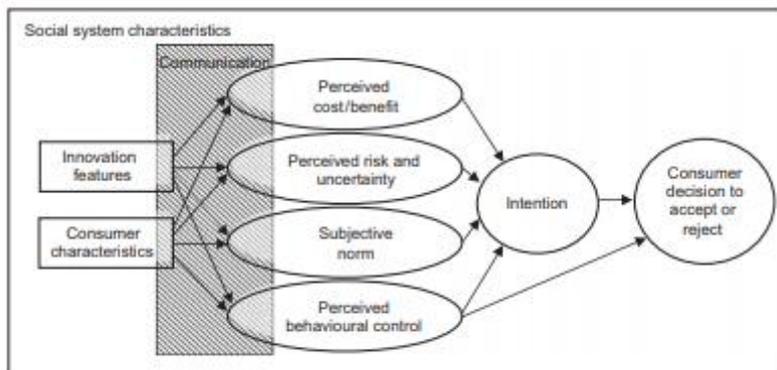


Figure 2. Conceptual framework for research on acceptance of technology-based food innovation (Ronteltap et al., 2007).

Innovation features

In order to accept or reject an innovation in the food sector the features of an innovation seem to be an important factor. Some examples of innovation features are the price, complexity, convenience-related features and physical appearance (Ronteltap et al, 2007). When looking at innovations specific to PN advice the different types of advice also plays a role (Ronteltap et al., 2013). According to this research of Ronteltap et al. (2013) these different types are defined as: personal diet plan/advice, personal coaching, personal shopping list and personal lifestyle advice. However, the

way these innovations are presented to the consumer (communication channels) and the business model of the innovation are also used as a basis for personalisation. As said in the introduction biological information can also be used as characteristics of individuals (Ordovas, Ferguson, Tai & Mathers, 2019). In this research they separate this biological information into the genotype and phenotype of the consumers. Genotype is your hereditary information stored in your genes and phenotype is the visible characteristics of the hereditary information and how it is expressed. The kind of information used for the innovation is also an innovation feature.

Consumer characteristics

According to Ronteltap et al. (2017) consumer characteristics are defined as the social-demographic variables such as income, nationality, age, gender, race and familiarity. These characteristics have an impact in the decision-making of consumers.

Motivation of consumers also affects the decision-making process of eating healthy (Berezowska, Fischer & van Trijp, 2017). This research showed that people's need to engage in healthy behaviour is more based on extrinsic motivation because people want to achieve desired end states such as weight loss and muscle tone rather than the pleasure they could derive from healthy behaviour (intrinsic motivation). The same research shows the difference between autonomous motivation and controlled motivation. People with more autonomous motivation focus more on benefits-related factors. Those people with high level of autonomous motivation are more likely to strive for progress toward a goal. In contrast to autonomous behaviour you have controlled behaviour. This controlled behaviour is more predictive of negative behaviour related to worry and anxiety. The research showed that people with a high level of controlled motivation were more anxious about risk related issues (Berezowska, Fischer & van Trijp, 2017).

Communication

Communication is a very important aspect in consumer decision-making. In this model communication is displayed as a tool that can link the features of the innovations to consumer perceptions (Ronteltap et al, 2007). For example, how a message is brought to the consumer has impact in the decision-making. Framing is a good example to illustrate how communication influences decision-making. Kahneman and Tversky (1979) developed the prospect theory based on framing effects by making choices under uncertainty. They found out that messages focussed on a gain were interpreted very differently than the same message focussed on a loss. So by framing a message people can interpret a message differently.

Perceived cost/benefit

The perceived cost/benefit rate is comparable to the economic cost/benefit analysis. In the economic cost/benefit analysis the monetary benefits of a situation are summed and the monetary costs associated with taking that action are subtracted from the benefits (Kenton, 2019). This analysis helps people to calculate whether or not a situation is beneficial monetarily. In this model benefits and costs cannot always be expressed in money, so therefore the perceived costs and benefits are used in nutritional innovations.

Perceived risk and uncertainty

For consumers it can be hard to estimate the actual qualities of innovations. Therefore, the consumer's perception of risk and uncertainty concerning innovations plays an important role in acceptance by the consumer (Ronteltap et al., 2007). According to Kaplan et al. (1974) and Roselius (1971) perceived risk can be classified into five types: physical, psychological, social, financial, performance and time loss. Consumers intend to calculate the risk they take when making a decision. In order to do so they have to know the possible different outcomes. However these outcomes are not always available in the consumer's mind and therefore an analysis in uncertainty will be made (Zhang & Liu, 2011). So, when the possible outcomes are available for consumers you can speak of risk and when these possible outcomes are not available you can speak about uncertainty or perceived uncertainty (Mitchell, 1999). This perceived risk is necessary because rational consumers only accept (purchase) decisions only when they think the benefits of the decision outweigh the possible risks (Mitchell, 1999).

Risk benefit trade-off

Consumers make a trade-off between the risk from adopting an innovation and the benefits they perceive. Research showed that consumers are more likely to put their privacy concerns away when they expect positive benefits from the service. However, the level of intrusiveness of personal information such as DNA does raise the awareness of the privacy risk. However, asking less intrusive personal information of consumers when it comes to PN appears to be less effective (Berezowska, et al., 2015).

Subjective norm and Perceived behavioral control

In the current literature not much attention has been given to the role of subjective norm and perceived behavioral control on consumer acceptance of food technology and innovations (Ronteltap et al, 2007). Therefore, these two concepts will be shortly explained together. To explain these two concepts the theory of planned behavior of Ajzen (1991) will be used. The theory of planned behavior says that attitude towards the behavior, subjective norm and perceived behavioral control together form the intention of someone to perform a given behavior. The last two are also used in the model of Ronteltap et al (2007). According to Ajzen (1991) the subjective norm can be explained as the perceived social pressure to perform or not to perform the behavior. The perceived behavioral control is explained as the perceived ease or difficulty of performing the behavior (Ajzen, 1991).

Intention

The intention of the consumer is defined by: "Whether significant others are likely to endorse the use of the innovation or activity." (Ajzen, 1991). All factors mentioned before influence this intention of the consumer. After the intention is determined by the consumer, the consumer will either accept or reject the innovation.

Method

To get an answer on the research question: “*What is the acceptance of personalised nutrition advice among consumers?*” a systematic literature review has been conducted. The database Scopus was used to find relevant articles because Scopus is also available for people who cannot access the Wageningen database. In order to get only readable articles in the literature review the query will include a limitation that contains English articles only.

Block	Search term
Personal Nutrition advice	(“personal* nutrition* advice” or “individual nutrition* advice” or “personal* nutrient advice” or “individual nutrient advice” or “personal* diet* advice” or “personal* nutrition*” or “nutrition* advice” or “personal* nutrition* service*” or “personal* food advice” or “personal* food service*” or “personal* diet* service*” or “personal food coaching”)
Consumer perception	AND (“perceived cost benefit” or “perceived risk” or “perceived uncertainty” or “subjective norm” or “perceived behavioral control” or “perceived social pressure” or “social pressure” or “opinion*” or “perception” or “risk benefit” or motivation or “autonomous motivation” or “controlled motivation” or accept* or reject* or adopt* or approve or embrace or intention or attitude* or “privacy risk”)
Consumer	AND (consumer* or people* or public or population or citizen*)

Table 1: Search query

First consumer perception and the acceptance (accept* or reject* or adopt* or approve or embrace or intention or attitude*) were separated but this query was too specific and too many articles were excluded with this query, so therefore these two were combined in the block “Consumer perception”. The query as mentioned in table 1 resulted in 185 articles. These articles were first scanned by evaluating the abstract. After this only 55 articles were included and 130 articles were excluded. The reason for exclusion of these articles was that they were not relevant for the research (n=69), not related to consumer perspective (n=24), not related to personalisation of nutrition advice (n=24) or they were too specific (n=13).

After reading the 55 residual articles for full-text screening, 16 articles were included in the literature review. The reasons for excluding the other 39 articles were that they were not relevant (n=7), they were not related to the consumer perspective of PN (n=18), they were not related to PN (n=3), they were not available (n=5), they contained of literature research that was not useful (n=3), they were repetitive researches of articles that were already included (n=2) and one article was not available in English (n=1). An overview can be found in the prisma flow diagram below (figure 3).

PRISMA Flow Diagram

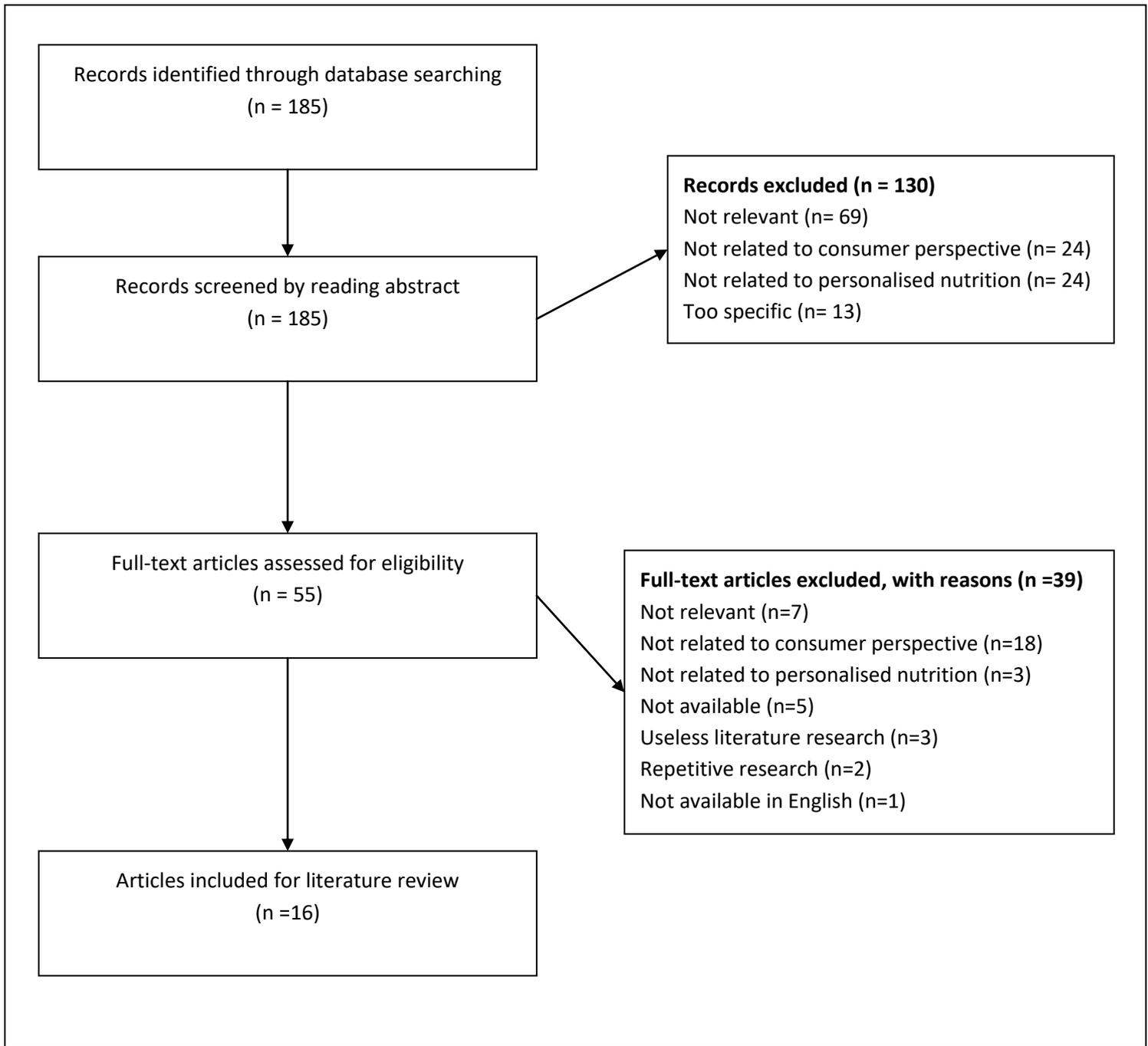


Figure 3: Prisma flow diagram

Results

The key results per article used for the literature review are shown in Appendix A. In this section the results of the literature review are discussed.

Innovation features

Different innovation features were mentioned in various articles from the systematic literature search. The most important ones are summed in the results. In four different studies price seemed to be a limitation when it comes to the intention of adopting PN advice (Vallée Marcotte et al., 2019 ; Fournier & Poulain, 2018 ; Ranking et al., 2018 ; Fallaize et al., 2015) and only one study showed that consumers were willing to pay a premium for PN advice (Stewart-Knox et al., 2016). However a higher price was sometimes associated with better quality and taking away privacy concerns caused a more positive intention about paying a higher price (Fallaize et al., 2015; Stewart-Knox et al., 2013). Ranking et al. (2017) mentioned the price as a commitment tool for consumers. Consumers said they would be more motivated to use PN when they had to pay for it.

Another innovation feature is the way PN advice is presented to consumers. Consumers have different preferences when it comes to what communication channel should be used with PN. The most frequently chosen communication channels were channels where personal contact was involved (Poinhos et al., 2017; Rankin et al., 2017; Fallaize et al., 2015; Berezowska et al., 2014; Stewart-Knox et al., 2013; Wendel et al., 2013). Face- to-face contact with the PN provider was mentioned in three studies (Fallaize et al., 2015; Berezowska et al., 2014; Stewart-Knox et al., 2013). The reasons for choosing face-to- face contact were: 1) the ability to trust people more when they see them in person; 2) the ease of giving large amounts of information; 3) it allowed them to be more honest and 4) they were more likely to give intrusive information when they see their provider in person. Combining personal contact with online contact was also an option for consumers (Ranking et al., 2017; Berezowska et al., 2014), but according to Berezowska et al. (2014) online contact was also perceived as bringing risk about data management. Trust was a recurring topic in all of the studies that contained information about communication channels.

Not only the way PN is presented to consumers is important, but also the provider of this PN is just as important. The provider of PN should be trusted by consumers in order to adopt PN (Ranking et al., 2017; Fallaize et al., 2015; Wendel et al., 2013; Berezowska et al., 2014; Stewart-Knox et al., 2013; Szakály, Polereczki & Kovács, 2016). The types of providers that are able to be trusted are not so easy to determine because of the varied findings. Three studies appointed experts, such as dieticians, as the best PN providers (Wendel et al., 2013; Berezowska et al., 2014; Szakály, Polereczki & Kovács, 2016; Vallée Marcotte et al., 2019). The reason for not seeing the government as a trustworthy provider is the possible “hidden agenda” and the conflict of interest of the government (Berezowska et al., 2014; Fallaize et al., 2015). However, research by Poinhos et al. (2017) showed that the European commission was preferred to act as service provider.

The kind of information asked for by PN was also influencing the intention of accepting the PN advice. Intrusive information can cause a high perceived risk and that can result in a lower intention to adopt (Berezowska et al., 2014; Berezowska et al., 2015). However, this intrusive information is often needed to create suitable PN advice. According to Berezowska et al. (2014) consumers are

more positive when PN was based on phenotype than information based on their DNA (genotype). Vallée Marcotte et al. (2019) found that health and disease prevention were seen as the best advantages of DNA-based PN advice, but for consumers giving DNA-based information caused fear and anxiety.

Consumer characteristics and personal related factors

As mentioned in the theoretical framework, people's motivation can be very helpful in giving an insight into their intention to adopt PN (Berezowska, Fischer & Van Trijp, 2017). Health seemed to have a positive influence on the attitude of the consumer, but it did not directly influence the intention to adopt. However, according to Ranking et al. (2018) people who were healthier seemed less likely to adopt because they thought they did not need PN. However, research of Street et al. (2017) about PN among employees showed that females, older people and people with a low BMI were more likely to adopt PN than males, younger people and people with a higher BMI. Another research showed that participants were more likely to change their diet when their behaviour positively influenced the health of their children (Fournier & Poulain, 2018). Ranking et al. (2018) mentioned weight control as an important motivator for the intention to adopt.

Ambivalent feelings had a negative influence on the intention to adopt. People use their feeling as a source of information when making decisions and when they experience these ambivalent feelings it will reduce their intention to adopt PN (Reinders et al., 2020).

Some of the studies in the literature review showed the differences of consumer perception and PN across countries (Poinhos et al., 2017; Stewart-Knox et al., 2016; Poinhos et al., 2014). The differences of consumer perception in countries can be explained by the social and cultural differences in these countries. Even within countries there are small differences in the perception of the factors that influence the intention to adopt PN (Fallaize et al., 2015). This means that no general PN system can be implemented in every country. In the literature there was not much information on the influence of consumer characteristics such as the differences in age, gender, race, etc., on PN.

Communication and message

The consumer perception of the different factors plays a very important role in the intention to adopt PN advice. The way these factors are communicated can influence the perception of consumers and that can have positive/negative consequences for the intention to adopt. A recurring topic is the communication of benefits (Berezowska et al., 2015; Poinhos et al., 2014; Stewart-Knox et al., 2016; Ronteltap et al., 2009). According to Berezowska et al. (2015) it is important to communicate the benefits people get from engaging in PN services rather than not engaging in PN services. Another finding is that the benefits communicated to the consumers should suit the consumer's personal goals (Poinhos et al., 2014). Framing can also influence the consumer's intention to adopt PN. When a health message such as PN is positively framed, consumers are more likely to value this message (about PN) (Szakály, Polereczki & Kovács, 2016).

Risk benefit and perceived risk

The risk-benefit calculus has a positive impact on the intention of consumers to adopt PN. This means that the intention will be higher when more benefits than risks are perceived (Reinders et al., 2020). These perceived benefits are very important when looking at the intention to adopt (Szakály, Polereczki & Kovács., 2016; Stewart-Knox et al., 2016; Poínhos et al., 2014; Wendel et al., 2013; Ronteltap et al., 2009) and according to Szakály, Polereczki & Kovács. (2016) these perceived benefits plays a larger role in the attitude towards PN than the actual benefits. The perceived benefits have a direct relation with the intention to adopt, but the perceived risk on the other hand has no direct influence on PN (Poínhos et al., 2014). However, the perceived risk does have some influence on the intention to adopt. This perceived risk can be linked to privacy issues and concerns about consumer privacy (Berezowska et al., 2015; Poínhos et al., 2014; Stewart-Knox et al., 2013; Wendel et al., 2013). Consumers were concerned about the data storage and data management of their personal information (Rankin et al., 2017; Fallaize et al., 2015; Poínhos et al., 2014; Stewart-Knox et al., 2013). The sale of personal data to third companies and telemarketers seemed one of the factors people were concerned about (Vallée Marcotte et al., 2019; Ranking et al., 2017).

Besides these privacy risks also other risks were mentioned by some of the articles. Fournier & Poulain (2018) said that the risk of domination the social cultural aspect, such as giving up certain products, was seen as a serious risk. The French people were concerned they had to give up a product like cheese that was seen as an important social cultural aspect. Another risk was that perceived eating context was seen as a potential barrier towards the adoption of PN (Reinders et al., 2020).

Self-efficacy

The perception of self-efficacy was mentioned in two articles as a factor that influences the intention to adopt PN (Rankin et al., 2017; Poínhos et al., 2014). Higher perceived self-efficacy leads to a more positive view on the consumer's intention to adopt, so increasing the perception of self-efficacy could help acceptance of PN (Poínhos et al., 2014). Ranking et al. (2017) even said that to enhance self-efficacy people should feel more commitment. The lack of willpower of consumers is a barrier to the acceptance of PN (Stewart-Knox et al., 2013).

Discussion and Conclusion

The aim of this research was to investigate which factors influence consumer acceptance of PN and in what way. This was done by using the consumer's intention to adopt PN as a guideline. Many different factors directly or indirectly influenced this intention to adopt PN. However, a recurring subject was trust and perception. Trust is very important when it comes to the provider of PN and the way providers are handling the intrusive information of consumers. The consumer's perception of different factors is also an important factor that must be taken into account when looking at the intention to adopt PN.

When looking at the price of PN services consumers are divided in their opinion. Some claims that a higher price will lead to higher commitment and others see the price as a limitation to use PN. The way to present PN should include a form of face-to-face contact and it should be provided by a provider who can be trusted. However, there was some disagreement about the type of provider that should be used. For consumers the release of intrusive information is a limitation to the intention to adopt. They prefer giving information based on their phenotype rather than on their DNA.

Next to that, the motivation of consumers can also influence their intention to adopt PN. Two studies contradict each other when it comes to health as a motivator. One says that people who live in a healthy way are less likely to adopt PN (Ranking et al., 2018), and the other one says people with a higher BMI are less likely to adopt PN (Street et al., 2017). When people perceive ambivalent feelings about PN their intention to adopt PN will decrease. Self-efficacy, on the other hand, is positively linked to the intention to adopt PN.

In general, the consumer perception of factors is important when looking at the intention to adopt PN. The trade-off between the perceived risks and perceived benefits when making a decision is very important because when more benefits than risks are perceived by the consumer the intention to adopt will be higher. However, that does not mean that perceived risks are not important. Perceived risks are mostly linked with privacy concerns and data storage/management and have a negative influence on the intention to adopt. The perceived benefits, on the other hand, positively influence the intention to adopt, and they seemed to be more important than the actual benefits people received of PN.

Then, the way these benefits are communicated is essential for the intention of consumers to adopt PN. A positively framed message ensures a higher intention to adopt and the type of benefits communicated can also make a difference here. It will not work to implement one PN service in different countries, due to the cultural and social differences among consumers. So, there is not one specific factor that explains the intention to adopt PN but you should take all the factors mentioned in this research in consideration when looking at the acceptance of PN.

Limitations and Future Research

In this literature review, articles were assessed and selected in a systematic and structured way, based on their relevance to the research. However, the researcher could have missed some important articles by wrong interpretation of the abstract or due to personal preferences and prejudices. Ideally, a second reviewer would conduct the screening as well.

Also, the research mostly focused on the consumer perspective of PN and factors that might influence their intention to adopt PN. However, ethical concerns and issues were not taken into account in this research. According to Görman (2007) ethical issues, such as the availability of intrusive information of consumers, are being raised, and it would be interesting to have more in-depth research about these ethical issues when it comes to the application of PN.

The articles found in this literature research often contained the same aspects and factors and conclusions when it came to the intention to adopt PN. The articles were often somewhat general and that could be due to the long and specific query. Therefore, it could be interesting for future research to get more in-depth insights into the aspects of the different factors and how they relate to the acceptance of PN.

Lastly, the risks explained in this research are mostly concerned with privacy risks and data management because these are the most common risks perceived by the consumer when talking about PN. Follow-up research about other, not only perceived but also practical, risks that come with PN is needed.

The follow-up researches mentioned above together with this research about consumer perspective of PN, could give a more complete view for the implementation of PN services and applications.

Appendix A

Study	Topic	Measures	Results
Berezowska et al. (2014)	Qualitative study about the evaluation of PN. Practical findings and implications.	Privacy calculus, perceived benefit, intention to adopt, Information and communication	The preferred PN service was a “health club” and face-to-face services. The participants wanted personal contact because it was easier and allowed them to be more honest. Online contact was not an issue when it was combined with personal contact, but they were concerned about the risk of online data. When PN advice was give based on phenotype people were positive but when it was based on DNA people had more concerns. This was mainly caused by the lack of knowledge about DNA testing. The service should be provided by trustworthy experts and not by external companies or the government because consumer thought they had so called “hidden agendas”. A lock-in method was perceived very negatively and could result in unhealthy behaviour and companies taking advantage of the service. A PN service would be appreciated more when it also contained exercises and lifestyle advice instead of only nutritional advice.
Berezowska et al. (2015)	Adoption of PN services.	Privacy calculus, perceived (privacy) risk, perceived benefits, perceived effectiveness, information intrusiveness	The consumer’s intention to adopt PN advice depends more on the perceived benefits than the perceived risks. However, service providers should take privacy issues that come with intrusive information very seriously because this can cause a high perceived risk and that may lead to less intention to adopt. Furthermore, it is important to communicate the positive benefits people get from engaging with PN services rather than not engaging in such services.
Fallaize et al. (2015)	Consumer’s opinion of different factors in PN advice in the UK (collected on behalf of the Food4me study).	Motivation of PN, trust, privacy concern, commitment, costs	Neither commercial companies nor the government were fully trusted by the participants as providers for PN because of conflict of interests. The biggest concerns were about the transportation and storage of data. The different methods that were appraised by the participants were face-to-face, internet and telephone. They were more likely to give intrusive information when the contact was face-to-face. The cost of PN was linked to a higher commitment and to quality.
Fournier & Poulain (2018)	Exploring the French public’s understanding of and reactions to PN (tests).	Perceived risk and benefit, willingness of use, cost-benefit, responsibility	The main issue participants had was the risk of dominating the social cultural aspects such as giving up certain products (cheese in French). The price of testing was also a factor that limited the willingness of use. One of the biggest concerns was privacy and people were afraid that it might influence their everyday life. It was remarkable was that they were more likely to change their diet when it had a positive influence on their children’s health.
Póinhos et al. (2014)	Determinants of consumer acceptance of PN across 9 countries.	Self-efficacy, locus of control, perceived benefit, perceived risk, attitudes, and intention to adopt	Perceived benefits among consumers had a direct relation to the intention to adopt PN. Perceived risk, on the other hand had no direct influence on PN and an inverse relation to perceived benefits. However perceived risk did play a role in broader concerns such as the delivery system and the transportation and storage of personal data. High perceived self-efficacy and a positive attitude also influenced the intention to adopt in a positive way. The communication of benefits was very important, especially specific benefits that suit their personal goals. There small differences across countries due to social and cultural differences, and therefore there is no general service that will suit every country.

Poinhos et al. (2017)	Factors that influence consumers trust and preferences towards personal nutrition advice.	Intention to adopt PN, trust in PN services, trust in actors of PN, preferences of communication, preferences of PN services	The main predictors of the intention of consumers to adopt PN were greater trust in dieticians/nutritionists as service providers, the European Commission as service regulator, online PN companies as information source and email contacts as a communication channel. Among countries the factors differs, meaning that not one strategy is suitable for all countries, and PN should be provided in different forms for different countries due to cultural differences.
Rankin et al. (2017)	Perceived requirements of PN: Food4me.	Risk benefit, intention to adopt, self regulation, self monitoring	Individual motivational factors played a huge role in the adoption of PN. Some participants did not think PN was more effective than general nutrition advice and held negative outcome expectations because of the lack of data protection and the potential sale of data to third companies. The participants find familiarity and the recognition of trusted companies/ logo's important. Also getting feedback online and in person was seen as useful. To enhance self-efficacy participants recommended that the PN should cost money so you would be more committed when you pay for such a service.
Ranking et al. (2018)	Online survey across 9 countries about their attitude towards food choices and PN and the possible adoption of such PN.	Attitude, motive, intention to adopt	People with a more positive attitude towards personal nutrition (PN) were more likely to adopt it. People who were more motivated by health were also more likely to have a positive attitude, but this did not mean they were more likely to adopt. Weight control was seen as a positive factor (motivator) to both attitude and the intention to adopt. Ethical concerns were the least important factor in making food choices. The price of food was an important factor for people because they were anxious that they could not afford the food for the PN. Therefore price and familiarity had a negative influence on attitudes towards PN and should be taken into consideration.
Reinders et al. (2020)	Consumer acceptance of PN: The role of ambivalent feelings and eating context.	Intention to use PN advice, risk-benefit calculus, ambivalent feelings, personal benefit, privacy risk, eating context barrier.	Privacy risk and ambivalent feelings are moderately perceived by the participants, but ambivalent feelings are negatively correlated to intention to adopt. They perceive more benefits than risks and they perceived eating context as potential barrier towards the adoption of PN advice. The risk-benefit calculus had a positive impact on the intention (when more benefits are perceived). Ambivalent feelings about personal nutrition negatively influenced the intention to adopt.
Rontelap et al. (2009)	Quantitative study about the acceptance of PN. by framing a message.	Perceived risk, perceived uncertainty, subjective norm, perceived cost benefit, perceived behavioural control, self-efficacy	The perceived costs and benefits to consumers seem to be most important for the acceptance of PN advice. The perceived benefits should be valuable for the consumer and very clear. To adopt such advice consumers need to have control of their personal information. It was not clear from this research whether or not framing manipulation was successful or whether or not the acceptance of PN advice was influenced by message framing.
Stewart-Knox et al. (2013)	Qualitative study about the factors that influence the uptake of PN.	Awareness, communication, perceived benefit, perceived risk, price, trust, willpower, motivation	PN was perceived as being beneficial with a variety of the participants. The motivation factors for using PN were health management, weight reduction to improve health outcomes and athletic performance. However, lack of willpower was identified as barrier to PN along with the dislike of recommended food and the need to cook too many different meals in one family. The best way to provide PN seemed personal (face-to-face) and professional contact. Trust was a recurring factor in many of these factors,

			such as service provider, communication of the service and personal data management. Concerns about PN were mostly linked to privacy and data management. Price was related to quality and took away some concerns about privacy and gave more trust due to contractual and legal rights.
Stewart-Knox et al. (2016)	What is the best policy for consumers to adopt PN? A literature review among 9 EU countries.	Public perspective, perceived benefits and barriers, trust in providers	The majority of the society is willing to pay a premium for PN. The perceived benefits of the consumer are very important in the intention to adopt PN. However, not all countries give the same results and therefore different approaches should be used in different countries. In order to gain the trust of the public the delivery of PN information should be regulated. Policies should remove barriers and promote the benefits of PN in order to encourage the uptake of it.
Street et al. (2017)	Employee information about the opinion of PN among employees in Australia.	Desire and intention to improve PN, desire for assistance in PN, consumer characteristics and intention	2/3 of the participants had the intention to improve their personal nutrition to eat better. 74.5 Percent said they would like assistance with nutrition and only 27.8 percent wanted healthy options at work. Employees rather wanted more information about healthy food provided at their work than eating healthier food at their work. The majority of the employees did not want individual coaching sessions provided by nutrition specialists. However, female employees, older employees and employees with a low BMI were more likely to intend to participate in nutrition coaching than male employees, younger employees and employees with a higher BMI.
Szakály, Polereczki & Kovács. (2016)	Consumers opinion on personalised nutrition based on genetic testing.	Consumer attitudes, genetic testing, nutrigenomics PN, consumer perception, perceived risk, communication	Consumers were doubtful about genetic testing mostly because they were insecure. By framing health messages positively, consumers are more likely to give higher scores to the preferences of PN. The role of trusted experts also leads to a higher score. The consumer perception of the benefits/ advantages plays a bigger role in the attitude towards PN than the benefits themselves.
Vallée Marcotte et al. (2019)	Evaluation of attitudes, perceptions and concerns about nutrigenetic testing for PN in Canada.	Health care professional preference, perceived advantages and disadvantages and general concerns about nutrigenetic testing	Participants preferred getting nutritional advice from a dietician 93,3%. But university research labs should be the best source for personal information. Health and disease prevention were seen as the best advantage of DNA-based nutrition advice and diet related restrictions and worry/fear/anxiety as most frequently chosen disadvantages. The main general concerns were the availability of personal genetic data for telemarketing and use by other companies. Price seemed to be a limited factor for men and women.
Wendel et al. (2013)	Advice to companies based on research about consumer's intention to use health recommendation systems for PN advice.	Intention, cost benefit, privacy risk, usefulness	The perception of costs and benefits, privacy risks and usefulness are strong predictors of the intention of consumers to use a health recommendation system. Consumers want personal contact to get these recommendations and have concerns with such a system when it comes to privacy. They want their provider to be an expert who can reassure them.

References

- Ajzen, I. (1991). The Theory of Planned Behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179-211. [https://doi.org/10.1016/0749-5978\(91\)90020-T](https://doi.org/10.1016/0749-5978(91)90020-T)
- Allerhande. (Retrieved on April 14th 2020). Allerhande, zo lukt elk recept. Retrieved from: <https://www.ah.nl/allerhande/over-allerhande>
- Author unknown. (2019, 8 January). Acht feiten over online boodschappen[Logistiek]. Retrieved from: https://www.logistiek.nl/supply-chain/artikel/2019/01/acht-feiten-over-online-boodschappen-101166610?_ga=2.128750220.1812095224.1585052193-1848520509.1585052193
- Berezowska, A., Fischer, A.R.H., Ronteltap, A., Van der Lans, I.A., & Van Trijp, H.C.M. (2015). Consumer adoption of personalised nutrition services from the perspective of a risk-benefit trade-off. *Genes & Nutrition*, 10(42), 1-14. DOI 10.1007/s12263-015-0478-y
- Berezowska, A., Fischer, A.R.H., & Van Trijp, H.C.M. (2017). The moderating effect of motivation on health-related decision-making. *Psychology & Health*, 32(2), 665-685. DOI: 10.1080/08870446.2017.1293055
- Berezowska, A., et al. (2014). Understanding consumer evaluations of personalised nutrition services in terms of the privacy calculus: A qualitative study. *Public Health Genomics*, 17(3), 127-140. DOI: 10.1159/000358851
- Cees, O. (2016, 24 May). Japan laat de schijf van vijf tollen. Retrieved from: <https://www.katernjapan.nl/japan-laait-schijf-vijf-tollen/>
- Celis-Morales, C. et al. (2017). Effect of personalized nutrition on health-related behaviour change: evidence from the Food4me European randomized controlled trial. *International Journal of Epidemiology*, 46(2), 578-588. <https://doi.org/10.1093/ije/dyw186>
- Clement, J. (2019, 30 August). E-commerce share of total global retail sales from 2015 to 2021 [Statista]. Retrieved from <https://www.statista.com/statistics/534123/ecommerce-share-of-retail-sales-worldwide/>
- Conway, J. (2020, 13 January). U.S. online grocery sales 2018-2023 [Statista]. Retrieved from <https://www.statista.com/statistics/293707/us-online-grocery-sales/>
- De Best, R. (2019, 28 October). Leading online supermarkets in the Netherlands, by market share 2015-2019 [Statista]. Retrieved from: <https://www.statista.com/statistics/659373/leading-online-supermarkets-based-on-share-of-shoppers-in-the-netherlands/>
- Evert, A.B., et al. (2014). Nutrition Therapy Recommendations for the Management of Adults with Diabetes. *Diabetes Care*, 37(1), S120-S143. <https://doi.org/10.2337/dc14-S120>

- Fallaize, R., et al. (2015). The perceived impact of the National Health Service on personal nutrition service delivery among the UK public. *British Journal of Nutrition*, 113(8), 1271-1279. Doi:10.1017/S0007114515000045
- Fournier, T., & Poulain, J.P. (2018). Eating According to One's Genes? Exploring the French Public's Understanding of and Reactions to Personalized Nutrition. *Qualitative Health Research*, 28(4), 2195-2207. <https://doi.org/10.1177/1049732318793417>
- Görman, U. (2007). Some ethical issues raised by personalized nutrition. *Genes Nutrition*, 2(1), 55-58. DOI 10.1007/s12263-007-0013-x
- Kahneman, D., & Tversky, A. (1979). Prospect Theory: An Analysis of Decision under Risk. *Econometrica*, 47(2), 263-292. DOI: 10.2307/1914185
- Kaplan, L.B., Szybillo, G.J., & Jacoby, J. (1974). Components of perceived risk in product purchase: a cross validation. *Journal of Applied Psychology*, 59 (3), 278–291. <http://dx.doi.org/10.1037/h0036657>
- Kenton, W. (2019, 23 June). Cost-Benefit Analysis [Investopia]. Retrieved from: <https://www.investopedia.com/terms/c/cost-benefitanalysis.asp>
- Maffeis, C., & Tatò, L. (2001). Long-Term Effects of Childhood Obesity on Morbidity and Mortality. *Hormone Research in Paediatrics*, 55(1), 42-45. <https://doi.org/10.1159/000063462>
- Metzger, M. J., & Docter, S. (2003). Public Opinion and Policy Initiatives for Online Privacy Protection. *Journal of Broadcasting & Electronic Media*, 47(3), 350-374. https://doi.org/10.1207/s15506878jobem4703_3
- Mitchell, V.W. (1999). Consumer perceived risk: conceptualisations and models. *European Journal of Marketing*, 33(1/2), 163-195. <https://doi-org.ezproxy.library.wur.nl/10.1108/03090569910249229>
- The Naked Nutritionist. (Retrieved on April 14th 2020). Personalised Nutrition. Retrieved from: <https://www.thenakednutritionist.co.uk/personalisednutrition>
- Ordovas, J.M., Ferguson, L.R., Tai, E.S., & Mathers, J.C. (2018). Personalised nutrition and health. *Science and Politics of Nutrition*, <https://doi.org/10.1136/bmj.k2173>
- Póinhos, R., et al. (2014). Psychological determinants of consumer acceptance of personalised nutrition in 9 countries. *PLoS ONE*, 9(10). doi:10.1371/journal.pone.0110614
- Póinhos, R., et al. (2017). Providing Personalised Nutrition: Consumers' Trust and Preferences Regarding Sources of Information, Service Providers and Regulators, and Communication Channels. *Public Health Genomics*, 20(4), 218-228. DOI: 10.1159/000481357
- Puglisi, S., Rebollo-Monedero, D., & Forné, J. (2017). On web user tracking of browsing patterns for personalised advertising. *International Journal of Parallel, Emergent and Distributed Systems*, 32(5), 502-521. <https://doi.org/10.1080/17445760.2017.1282480>
- Rankin, A., et al. (2017). Public perceptions of personalized nutrition through the lens of Social Cognitive Theory. *Journal of Health Psychology*, 22(10), 1233-1242. DOI: 10.1177/1359105315624750

- Ranking, A., et al. (2018). Food choice motives, attitude towards and intention to adopt personalised nutrition. *Public Health Nutrition*, 21(14), 2606-2616. doi:10.1017/S1368980018001234
- Reinders, M.J., Bouwman, E.P., van Den Puttelaar, J., & Verain, M.C.D. (2020). Consumer acceptance of personalised nutrition: The role of ambivalent feelings and eating context. *PLOS ONE*, 15(4). <https://doi.org/10.1371/journal.pone.0231342>
- Ronteltap, A., & Van Trijp, H. (2007). Consumer acceptance of personalised nutrition. *Genes & Nutrition*, 2(1), 85-87. <https://doi-org.ezproxy.library.wur.nl/10.1007/s12263-007-0003-z>
- Ronteltap, A., Van Trijp, H., Berezowska, A., & Goossens, J. (2013). Nutrigenomics-based personalised nutritional advice: in search of a business model. *Genes & Nutrition*, 8(2), 153. <https://doi.org/10.1007/s12263-012-0308-4>
- Ronteltap, A., Van Trijp, J.C.M., Renes, R.J., & Frewer, L.J. (2007). Consumer acceptance of technology-based food innovations: Lessons for the future nutrigenomics. *Appetite*, 49(1), 1-17. doi:10.1016/j.appet.2007.02.002
- Ronteltap, A., van Trijp, J.C.M., & Renes, R.J. (2009). Consumer acceptance of nutrigenomics-based personalised nutrition. *British Journal of Nutrition*, 101(1), 132-144. Doi:10.1017/S0007114508992552
- Roselius, T. (1971). Consumer Rankings of Risk Reduction Methods. *Journal of Marketing*, 35(1), 56-61. DOI: 10.2307/1250565
- Street, T.D., Lacey, S.J., & Grambower, J.A. (2017). Employees prefer information more than free food. *International Journal of Workplace Health Management*, 10(4), 332-342. DOI 10.1108/IJWHM-02-2017-0013
- Stewart-Knox, B.J., et al. (2013). Factors influencing European consumer uptake of personalised nutrition. Results of a qualitative analysis. *Appetite*, 66, 67-74. <https://doi.org/10.1016/j.appet.2013.03.001>
- Stewart-Knox, B.J., et al. (2016). Making personal nutrition the easy choice: Creating policies to break down the barriers and reap the benefits. *Food policy*, 63, 134-144. <https://doi.org/10.1016/j.foodpol.2016.08.001>
- Szakály, Z., Polereczki, Z., & Kovács, S. (2016). Consumer attitudes towards genetic testing and personalized nutrition in Hungary. *Acta Alimentaria*, 45(4), 500-508. DOI 10.1556/066.2016.45.4.6
- USDA ChooseMyPlate. Dietary guidelines for Americans 2015-2020. Retrieved from: <https://www.choosemyplate.gov/eathealthy/dietary-guidelines>
- Vallée Marcotte, B., Cormier, H., Garneau, V., Robitaille, J., Desroches, S., & Vohl, M.C. (2019). Nutrigenetic Testing for Personalized Nutrition: An Evaluation of Public Perceptions, Attitudes and Concerns in a Population of French. *Lifestyle Genomics*, 11(3-6), 155-162. DOI: 10.1159/000499626
- Voedingscentrum. (Retrieved on April 14th 2020). Mijn eetmeter. Retrieved from: <https://mijn.voedingscentrum.nl/nl/eetmeter/>

Wendel, S., Dellaert, B.G.C., Ronteltap, A., & Van Trijp, H.C.M. (2013). Consumers' intention to use health recommendation systems to receive personalised nutrition advice. *BMC Health Services Research*, 13(1). Doi:10.1186/1472-6963-13-126

World Health Organisation. (2020, 3 March). Obesity and overweight. Retrieved from: <http://www.who.int/mediacentre/factsheets/fs311/en/>. Published 2018. Accessed 4th June 2019.

Zhang, G., & Liu, Z. (2011). Effects of influential factors on consumer perceptions of uncertainty for online shopping. *Nankai Business Review International*, 2(2), 158-171. DOI 10.1108/20408741111139927